

REMARKS

The above amendments to the above-captioned application along with the following remarks are being submitted as a full and complete response to the Official Action dated August 22, 2005 and the phone call with the Examiner on September 21, 2005. In view of the above amendments and the following remarks, the Examiner is respectfully requested to give due reconsideration to this application, to indicate the allowability of the claims, and to pass this case to issue.

Status of the Claims

Claims 1-20 are under consideration in this application. Claim 1 is being amended, as set forth in the above marked-up presentation of the claim amendments, in order to more particularly define and distinctly claim applicants' invention.

The claims are being amended to correct formal errors and/or to better recite or describe the features of the present invention as claimed. All the amendments to the claims are supported by the specification. Applicants hereby submit that no new matter is being introduced into the application through the submission of this response.

Formality Rejection

The claims and the abstract were objected for various formal errors, and has requested correction thereof, especially the spacing between words (e.g., the 3rd line of the Abstract). The Examiner agreed during the phone call that that the line spacing in the Abstract and the claims of 1.5 lines was sufficient, but not the spacing between words.

As the spacing between words is being adjust as requested by the Examiner, the withdrawal of the outstanding informality rejection is in order, and is therefore respectfully solicited.

Prior Art Rejection

Claims 1-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 5,579,474 to Kakuta et al. (hereinafter "Kakuta") in view the US Patent No. 6,442,711 to Sasamoto et al. (hereinafter "Sasamoto"). The prior art references made of record but not cited were pertinent to the disclosure of the invention. This rejections has been carefully considered, but is most respectfully traversed, as more fully discussed below.

The disk array system 10 of the invention (for example, the embodiment shown in

Figs. 1 & 5), as recited in the claim 1, comprises: a channel adapter 11 for controlling data transfer with respect to a host device 1; a plurality of data disk drives 16 configuring a RAID group 17; at least one spare disk drive 16(SP) provided as a spare for the data disk drives 16; a disk adapter 12 for controlling data transfer with respect to the data disk drives 16 and the spare disk drive 16(SP); a cache memory 14 used by the channel adapter 11 and the disk adapter 12 for storing data; a control memory 13 used by the channel adapter 11 and the disk adapter 12 for storing control information; a backup storage 17(S) provided separately from the data disk drives 16 and the spare disk drive 16(SP); a first control unit provided in the disk adapter 12 for observing occurrence of access error with respect to the data disk drives 16, the first control unit, when the frequency of occurrence of the access error exceeds a predetermined threshold, copying data stored in the data disk drive 16 exceeding the threshold to the spare disk drive 16(SP) via the cache memory 14 (p. 23, 2nd paragraph); a second control unit provided in the disk adapter 12 for processing access request directed to the RAID group 17 during the copying process, the second control unit making the backup storage 17(S) take over a write request directed to the RAID group 17; and a third control unit provided in the disk adapter 12 for copying data written in the backup storage 17(S) by the second control unit to the data disk drives and the spare disk drive other than the data disk drive exceeding the threshold when the copying process by the first control unit is finished.

Claim 1 is representative and is directed toward a disk array system including first, second, and third control units, with the first control unit observing frequency of disk access error above a threshold and copying data into cache memory in response, the second control unit processing access requests and making backup storage during the copying, and a third control unit copying data in the backup storage. Claims 11 and 17 are directed to the same invention and set forth operations as methods of steps. Claim 11 recites: a third step of associating the RAID group with the backup storage by starting the copying process in the first step; a fourth step of judging whether or not an access request directed to the RAID group has issued during the copying process in the first step; and a fifth step of writing data in the backup storage associated in the third step when issue of the access request is detected in the fourth step, and if the access request is a write request. Claim 17 recites: an access request detecting step for detecting whether or not an access request directed to the RAID group has issued during the copying process in the data copying step; and an access processing step for writing data relating to the write request to a normal disk drive different from the normal disk

drive in which the data is copied when a write request is detected in the access request detecting step.

Applicants respectfully submit that neither Kakuta nor Sasamoto teach or suggest applying such a “second control unit provided in the disk adapter 12 for processing access request directed to the RAID group 17 during the copying process, the second control unit making the backup storage 17(S) take over a write request directed to the RAID group 17, or a “third control unit provided in the disk adapter 12 for copying data written in the backup storage 17(S) by the second control unit to the data disk drives and the spare disk drive other than the data disk drive exceeding the threshold when the copying process by the first control unit is finished” according to the invention.

As admitted by the Examiner, Kakuta does not explicitly teach the first, second and third control units (p. 5, last line to p. 6, 2nd line of the outstanding Office Action). Kakuta’s predetermined/threshold value is only “a frequency of occurrence of read/write request” (col. 19, lines 6-7, 11-13), rather than any “frequency of occurrence of the access **error**” as in the invention. Kakuta merely monitors the numbers of read/write requests of the CPU 1 so to decide the timing for generating a new parity in the SCSI drive 12. Kakuta is *determined* to generate a new parity in the SCSI drive 12 (will happen no matter what and just a matter of timing), rather than backing-up a disk drive or generating a new parity *only if* a frequency of disk access **error** reaches a threshold (a non-timing condition which will not necessarily happen). As Kakuta does not whether any frequency of occurrence of the access **error** exceeds a predetermined threshold, it neither “copy data stored in the data disk drive 16 exceeding the threshold to the spare disk drive 16(SP) via the cache memory 14” as the first control unit of the invention. Since Kakuta does not offer such a copying processing, Kakuta does not “process any access request directed to the RAID group 17 *during the copying process*”, or “copy data written in a spare disk drive *during the copying process* to the data disk drives and the spare disk drive other than the data disk drive exceeding the threshold when the copying process by the first control unit is finished” as the second and third control unit of the invention.

Sasamoto was relied upon by the Examiner to compensate for Kakuta’s deficiencies. However, Sasamoto compares the calculated error rate with a threshold value of error rate to judge the reliability of operation of each of the plurality of data storage devices (col. 7, lines 58-61), then Sasamoto’s reproducing means 307 copies or regenerates the data on the half-

failed disk drive (step S13), and stores the reproduced data on a spare disk drive 103c (step S14) directly without involving a cache.

In addition, Sasamoto fails to consider any read/write request issued by the host during disk drive swap window. *“When none of the calculated values exceeds the threshold value specified in the system, the disk array control unit 101 waits for further Read/Write requests from the host computer 100. If at least one of the calculated values exceeds the threshold value The executing means 304 regards the disk drive as half-failed (see step 12). The reproducing means 307 copies or regenerates the data on the half-failed disk drive (see step S13), and stores the reproduced data on the spare disk drive 103c (see step S14). ... Then the disk array control unit 101 waits for further Read/Write requests from the host computer 100 (col. 5, lines 41-60).”* As Sasamoto does not take any read/write request during the copying process, it does not process any access request directed to the RAID group 17 during the copying process, or make the spare disk drive 103c take over a write request directed to the half-failed disk drive 103a as the second control unit of the invention. Sasamoto neither copy data written in the spare disk drive 103c during the copying process to the data disk drives and the spare disk drive other than the data disk drive exceeding the threshold when the copying process by the first control unit is finished” as the third control unit of the invention.

Applicants contend that neither Kakuta nor Sasamoto or their combination teach or disclose each and every feature of the present invention as disclosed in independent claims 1, 11 and 17. As such, the present invention as now claimed is distinguishable and thereby allowable over the rejections raised in the Office Action. The withdrawal of the outstanding prior art rejections is in order, and is respectfully solicited.

Conclusion

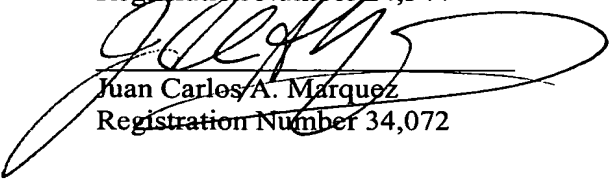
In view of all the above, clear and distinct differences as discussed exist between the present invention and the prior art references upon which the rejections in the Office Action rely, Applicant respectfully contends that the prior art references cannot anticipate the present invention or render the present invention obvious. Rather, the present invention as a whole is distinguishable, and thereby allowable over the prior art.

Favorable reconsideration of this application is respectfully solicited. Should there be any outstanding issues requiring discussion that would further the prosecution and allowance

of the above-captioned application, the Examiner is invited to contact the Applicant's undersigned representative at the address and telephone number indicated below.

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